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Epidemiology of Injuries and Illnesses During The United States Air Force Academy 2002 Basic Cadet Training Program

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Objective

- Basic Cadet Training (BCT) is the first experience a cadet has when they join the United States Air Force Academy (USAFA).
- The rapid physical and emotional conditioning that occurs during BCT creates ample opportunity for injuries and illnesses to occur.
- Studies on the risk factors for injury and illness during BCT have not been done in the basic cadet population.
- Because of the admissions requirements of the USAFA, prevention and control efforts that are specific to other military training populations are limited in their generalizability to the USAFA cadet population.
- **The goal of the following presentation will be to describe the current magnitude of the injury and illness problems during BCT and to identify potential risk factors for targeted prevention efforts.**





Data Sources

- **Global Expeditionary Medical System version 2.5 (GEMS)**
 - Software program developed by the Air Combat Command Surgeon General's Office.
 - Allows for automated data entry on all patient visits in the field.
 - Used to capture if the basic cadet had a medical visit, what the final diagnosis of the visit was, their SSAN, BCT squadron, and DOB.
- **Injury/illness Questionnaire**
 - Used to track how and where the basic cadets were being injured.
- **Form 18's**
 - Used to track training restrictions and the days of restricted duty.





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Results



Descriptive Characteristics of the USAFA Class of 2006 Basic Cadets, Summer 2002 Basic Cadet Training.

Variable	Male (N=986)	Female (N=224)	All (N=1210)
Gender	81.5%	18.5%	
Medical Waiver			
Received for USAFA Admission	7.9%	11.6%	8.6%
Did Not Receive for USAFA Admission	92.1%	88.4%	91.4%
Recruited Intercollegiate Athlete			
Yes	28.2%	28.1%	28.2%
No	71.8%	71.9%	71.8%
Out Processed			
Yes	7.9%	11.2%	8.5%
No	92.1%	88.8%	91.5%
Attended Military Prep School			
Yes	21.7%	17.4%	20.9%
No	78.3%	82.6%	79.1%
BMI*	24.2 ± 3.4	22.6 ± 2.5	23.9 ± 3.3
Underweight	1.1%	2.3%	1.3%
Normal	65.6%	80.6%	68.4%
Overweight†	27.2%	16.2%	25.1%
Obese‡	6.1%	0.9%	5.2%

*Body Mass Index (BMI) categorized according to Centers for Disease Control and Prevention (CDC) and National Heart Lung and Blood Institute (NHLBI) Standards: <18.5 Underweight, 18.5-24.9 Normal, 25.0-29.9 Overweight, and ≥ 30.0 Obese.

=1198

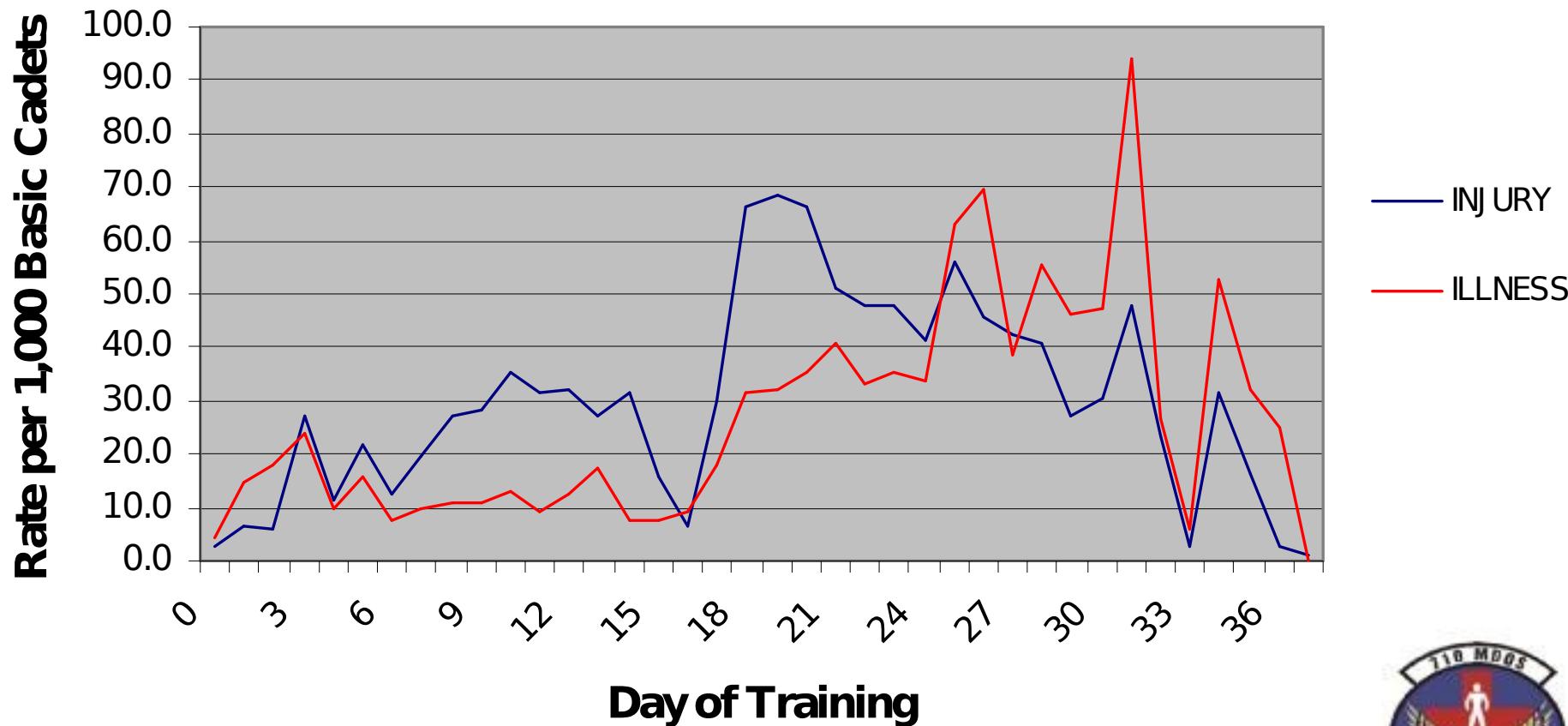
Descriptive Characteristics of the USAFA Class of 2006 Basic Cadets, Summer 2002 Basic Cadet Training, continued.

Variable	Male (N=986)	Female (N=224)	All (N=1210)
Medical Visit During BCT			
Yes	65.6%	83.9%	69.0%
No	34.4%	16.1%	31.0%
Total Number of Visits	1.8 ± 2.1	3.3 ± 2.8	2.1 ± 2.3
None	34.4%	16.1%	31.0%
One	22.0%	15.2%	20.7%
Two to Three	24.8%	29.0%	25.6%
More than Three	18.8%	39.7%	22.7%
Basic Cadet Injured During BCT	42.9%	66.5%	47.3%
Yes	56.6%	33.5%	52.3%
No	0.5%	0.0%	0.4%
Unknown			
Basic Cadet Ill During BCT			
Yes	45.9%	60.7%	48.7%
No	53.7%	39.3%	51.0%
Unknown	0.4%	0.0%	0.3%



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Injury and Illness Incidence by Day of Training



*All visits are initial visits to the medical clinic for an injury and/or illness.



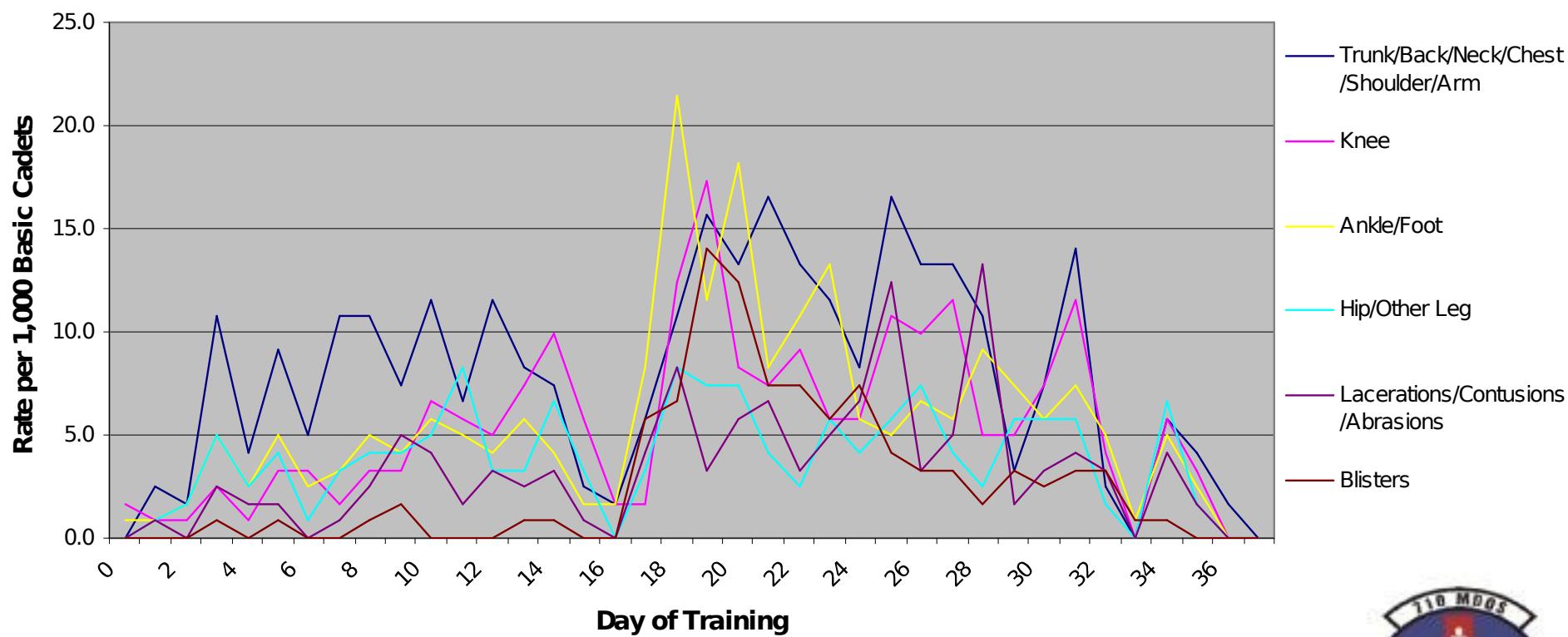
Injuries by Gender, USAFA Class of 2006, Summer 2002 Basic Cadet Training.*

Injury	Male	Female	All
All Medical Visits	1191	428	1619
All Injury Visits	607	239	846
Specific Injury Visits			
Trunk/Back/Neck/Chest/Shoulder/Arm	144	69	213
Sprain-trunk, back, neck	24	15	39
Sprain-arm, hand, shoulder	44	25	69
Knee	100	35	135
Joint/Muscle/Other Pain-knee	16	5	21
Sprain-knee	27	14	41
Tendinitis-knee	36	13	49
Ankle and Foot, excluding blisters	113	51	164
Sprain-ankle	70	28	98
Hip and Other Leg	86	33	119
Sprain-other leg, hip	35	13	48
Sprain-shin splints, lower leg	41	17	58
Lacerations/Contusions/Abrasions	76	28	104
Lacerations/Contusions/Abrasions-lower limbs	24	9	33
Lacerations/Contusions/Abrasions-trunk, head	26	10	36
Lacerations/Contusions/Abrasions-arm, hand	21	11	32
Blisters	55	24	79
Fractures	13	2	15
*All visits include initial visits to the medical clinic for an injury and/or illness.			



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Incidence of Most Common Injury Diagnoses by Day of Training



Illnesses by Gender, USAFA Class of 2006, Summer 2002 Basic Cadet Training.*

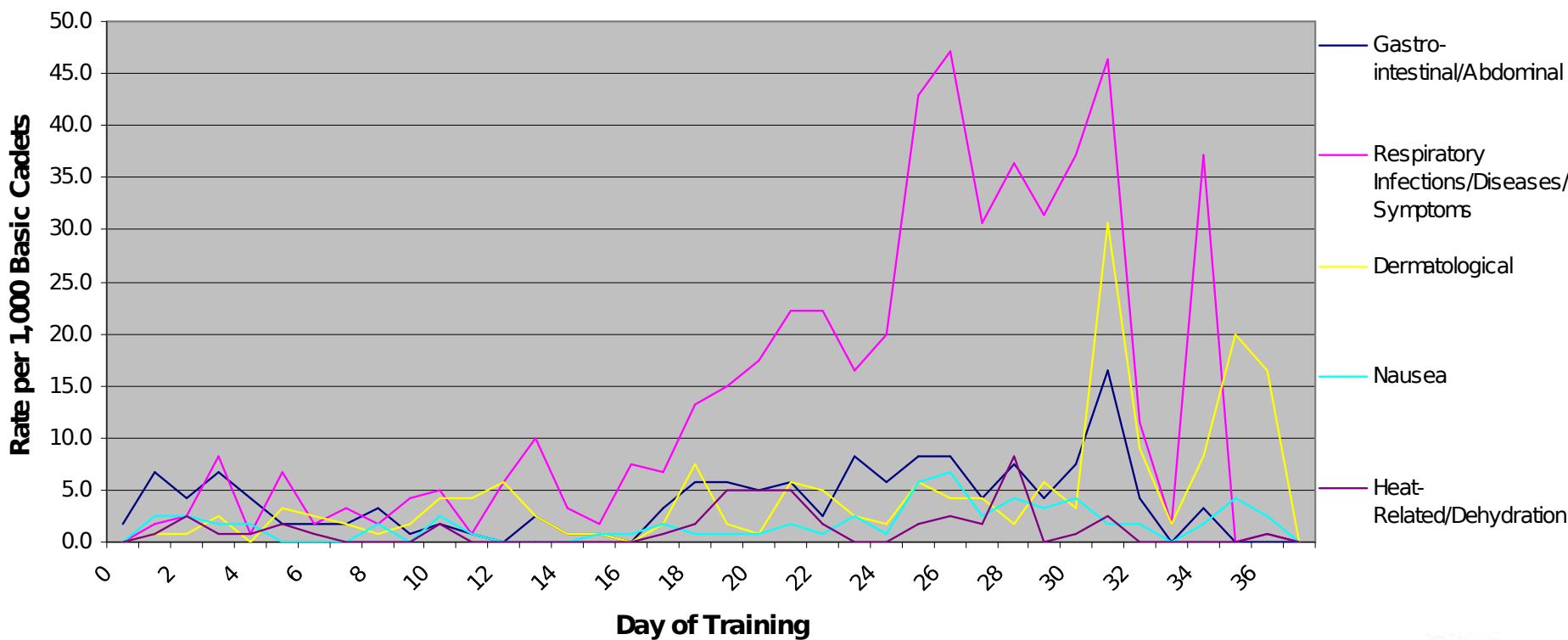
Injury	Male	Female	All
All Medical Visits	1191	428	1619
All Illness Visits	615	201	816
Specific Illness Visits			
Gastro-intestinal/Abdominal	81	28	109
Constipation	16	1	17
Diarrhea	9	2	11
Enteritis of Infectious Origin	32	17	49
Respiratory	336	88	424
Infections/Diseases/Symptoms	195	55	250
Acute URI	39	13	52
Sinusitis	27	4	31
Bronchitis	35	5	40
Pharyngitis	111	22	133
Dermatological	16	4	20
In-growing Nail	23	19	42
Nausea	30	17	47
Heat-Related/Dehydration	16	9	25
Dehydration	8	6	14
Headache	29	2	31
Cellulitis	0	19	19
Female			

*All visits are initial visits to the medical clinic for an injury and/or illness.



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Incidence of Most Common Illness Diagnoses by Day of Training



Associations Between Gender, Athletic Status, Medical Waiver, Prior Military Prep School Attendance, BMI, and Ethnicity with Having an Injury, Illness, and Out Processing During BCT 2002, Adjusted for Squadron and Sex.

Variable	Injury OR (95% CI*)	Illness OR (95% CI*)	Out Processing OR (95% CI*)
Sex	2.66‡ (1.96, 3.63)	1.81‡ (1.34, 2.44)	1.55 (0.96, 2.51)
Intercollegiate Athlete	1.53‡ (1.18, 1.98)	1.08 (0.83, 1.39)	0.78 (0.48, 1.26)
Medical Waiver	1.26 (0.83, 1.91)	1.11 (0.74, 1.67)	0.41 (0.15, 1.15)
Attended Military Prep School	1.26 (0.95, 1.68)	1.45‡ (1.09, 1.92)	0.70 (0.40, 1.23)
BMI Category†			
Normal	Reference Category	Reference Category	Reference Category
Overweight			
Obese	1.48 (1.12, 1.96)‡ 3.44 (1.94, 6.09)‡	1.25 (0.95, 1.64) 2.45 (1.41, 4.26)‡	1.24 (0.76, 2.02) 0.68 (0.21, 2.27)

†BMI categorized according to CDC/NHLBI Standards
significant at p<0.05

*CI (Confidence Interval)

‡Odds Ratio
(2.27)



Cumulative Incidence and Relative Risks of Injuries by Gender for the USAFA Class of 2006, Summer 2002 BCT.

Injury*	Male	Female	Relative Risk (f/m)	(95% CI)
	Incidence per 100 Basic Cadets	Incidence per 100 Basic Cadets		
All Injury Visits	61.6	106.7	1.73	(1.67, 1.80)‡
Specific Injury Visits				
Trunk/Back/Neck/Chest/Shoulder /Arm	14.8 10.1	30.8 15.6	2.08 1.54	(1.63, 2.66)‡
Knee	11.4	22.8	1.99	(1.08,
Ankle and Foot, excluding blisters	8.7	14.7	1.69	2.20)‡
Hip and Other Leg	7.7	12.5	1.62	(1.48,
Lacerations/Contusions/Abrasions	5.6	10.7	1.92	2.67)‡
Blisters	1.3	0.9	0.68	(1.16,
Fractures	1.6	1.8	1.10	2.46)‡
Other Injuries				(1.08, 2.44)‡
				(1.22, 3.03)‡
				(0.15, 2.98)
				(0.27



Cumulative Incidence and Relative Risks of Illnesses by Gender for the USAFA Class of 2006, Summer 2002 BCT.

Illness*	Male	Female	Relative Risk (f/m)	(95% CI)
	Incidence per 100 Basic Cadets	Incidence per 100 Basic Cadets		
All Illness Visits	62.4	89.7	1.44	(1.35, 1.54)‡
Specific Illness Visits				
Gastro-intestinal/Abdominal	8.2	12.5	1.52	(1.02, 2.28)‡
Respiratory	34.1	39.3	1.15	(0.96, 1.39)
Infections/Diseases/Symptoms	11.3	9.8	0.87	(0.57, 1.35)
Dermatological	2.3	8.5	3.64	(2.02, 6.56)‡
Nausea	3.0	7.6	2.49	(0.30, 1.26)
Heat-Related/Dehydration	2.9	0.9	0.30	(0.07, 1.26)
Cellulitis	N/A	8.5	N/A	(0.58, 2.72)‡
Female Other Infections	2.8	3.6	1.26	(1.40, 4.44)‡
Other Illnesses	6.1	11.2	1.83	(0.07, 1.26)

*All visits are initial visits to the medical clinic for an illness.

†Significant at p<0.05.

Prevalence of Form 18 Issuance for Injuries and Illnesses for Subgroups of the USAFA Class of 2006 Basic Cadets, Summer 2002 BCT.*

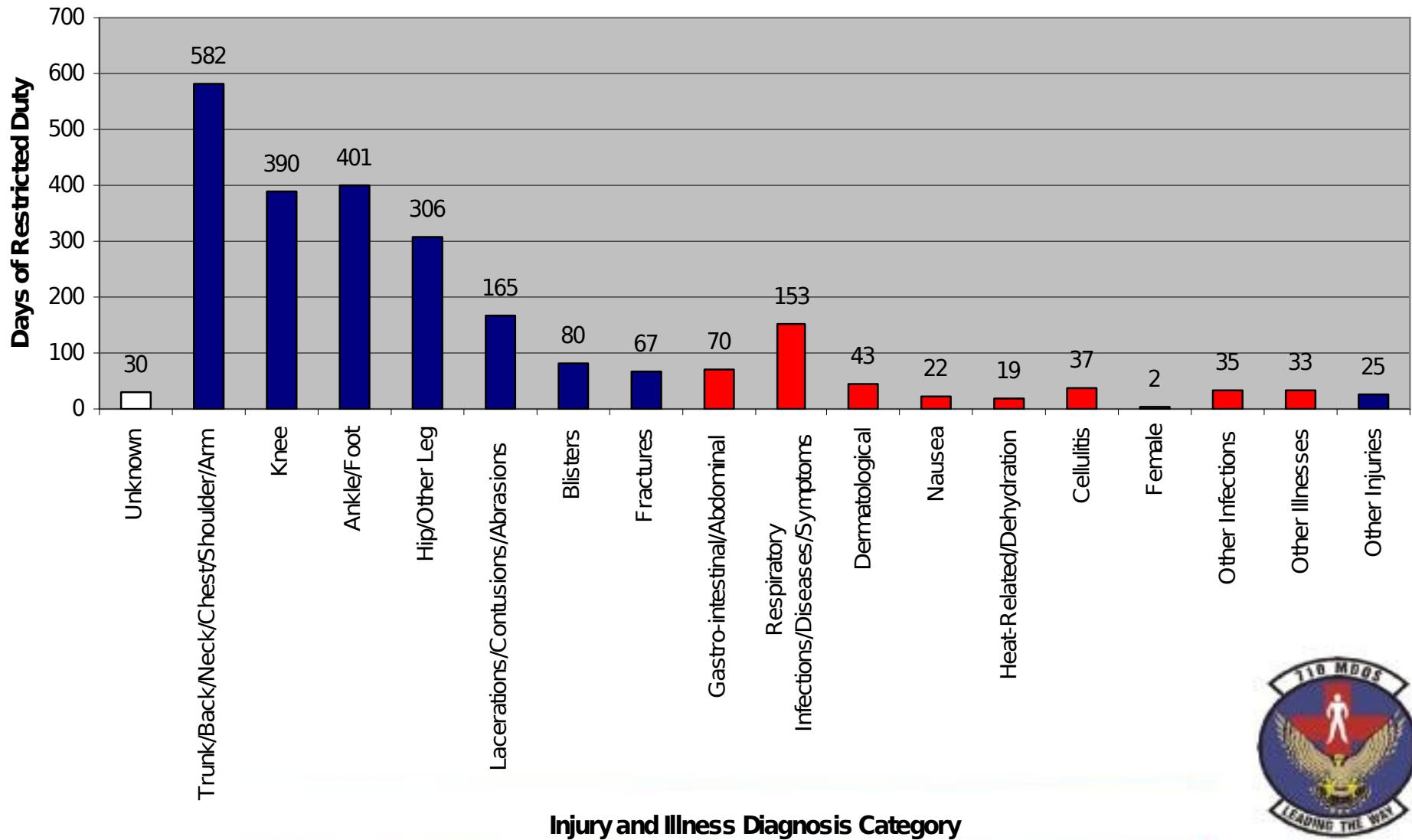
Variable	% Injury Visits Issued Form 18	Injury X ²	% Illness Visits Issued Form 18	Illness X ²
Sex - Male	0.507	2.095, df=1	0.192	3.662, df=1
Female	0.550	p=0.148	0.242	p=0.056
Squadron - A	0.514	7.907, df=8	0.152	7.906, df=8
B	0.516		0.224	
C	0.463	p=0.443	0.237	p=0.443
D	0.544		0.176	
E	0.497		0.212	
F	0.566		0.255	
G	0.471		0.183	
H	0.517		0.187	
I	0.582		0.202	
Intercollegiate Athlete - Yes	0.537	0.783, df=1	0.231	1.776, df=1
No	0.512	p=0.376	0.196	p=0.183
Medical Waiver - Yes	0.570	1.493, df=1	0.202	0.010, df=1
No	0.515	p=0.222	0.206	p=0.920
BMI Category [†] - Underweight	0.545	0.228, df=3	0.200	4.418, df=3
Normal	0.517		0.199	
Overweight	0.528	p=0.973	0.198	p=0.220
Attended Military Prep School	0.552	1.750	0.219	0.390

* BMI categorized according to [Obesity/NHLBI Standards](#). *All injuries and illnesses include initial and follow-up visits, does not include those not seen at the clinic.



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Days of Restricted Duty by Injury and Illness Diagnosis Category





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Discussion





Injury and Illness Incidence

- Increased from BCT I to BCT II.
- During BCT II, injury incidence decreased while illness incidence increased.
- Low spots occurred on July 4th (fireworks and “down day”), July 14th/15th (Doolie Day Out and march to Jack’s Valley), July 31st (march back from Jack’s).
- Overall number of initial injuries and illnesses fairly even.
 - Greater number of each during BCT II.
- Sprained ankles and acute URIs are hot spots for prevention.





Risk Factors for Injuries

- Female sex, Being an Intercollegiate Athlete, Overweight and Obese BMI
- NOT medical waiver or prior military experience as hypothesized.
- Football players at significantly increased risk.
 - BMI as a poor measure of obesity?
- Relative Risk for females significantly greater than males for all injury categories except fractures and other injuries.
 - However, female basic cadets did not appear to have gender specific injuries.
 - Rates were higher but relative occurrence similar between the sexes.
 - Similar results to study by Snedecor et al.



Risk Factors for Illnesses

- Female sex, Military Prep School Attendance, Obese BMI
- NOT medical waiver.
- Relative Risk for females significantly greater than males for GI, nausea, and cellulitis.
 - NO increased risk for respiratory illnesses





Limited Duty

- More females received Form 18s than males for illnesses.
- No difference in Form 18 prevalence or mean number of days for injuries across all subgroups.
- Injuries had significantly greater number of restricted duty days than illnesses.
 - Among injury categories there were differences in the mean number of days per Form 18.
 - Fractures vs. all other injury categories
 - No difference for illnesses.





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Summary

- Look at females, recruited athletes (particularly “larger” athletes), and those with high BMIs (with caution- consider athletic status).
- Focus on reducing ankle sprain injuries which resulted in 401 restricted training days.
 - In addition to lost training time from follow-up visits.
- Focus on methods to reduce respiratory infections.
 - Not many restricted duty days, but lots of lost training time caused by having to visit the clinic
 - Number have decreased over the years, methods introduced include cement padding and dust “binding” spray.
 - Initiating study to determine effect of pre-BCT smoking status on illness outcomes.





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Limitations

- Data collected from a surveillance system that was incomplete and unreliable.
- Misclassification bias in the coding of final diagnoses.
 - 17.2% of the diagnoses were initially missing and had to be tracked down or deciphered from basic cadet's medical complaint.
 - Broad coding of diagnosis categories helped control this noise.
- Missing data severely limited the limited duty analyses that could be performed.
- As a result of this analysis, a new surveillance system has been created that targets exactly what information we are interested in.





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